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Effect of Early Feeding of Finishing Rations on the Subsequent Performance of Broilers

A. L. PALAFOX*

Data on the effect of feeding low concentrations of protein in the diet of starting broiler chicks and on their subsequent growth to market age is limited. Roberts and Carrick (1942) found that broiler chicks receiving a 20 percent diet up to 6 weeks of age and then a 16 percent protein diet from 6 to 12 weeks grew as rapidly as those receiving 20 percent protein during the entire period. Douglas and Harms (1960) lowered the protein content of the diet of broiler chicks from 23 percent to 21 percent at 5 weeks with no significant effect on growth.

The present study deals with the effects of early feeding of finisher diets on the performance of New Hampshire cockerels and Brown Ledbrest x Arbor Acres sexed chicks.

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EXPERIMENT 1

Experimental Procedure

One hundred twenty 1-day-old New Hampshire cockerels of the University of Hawaii strain were randomized into 4 treatments with 3 replicates of 10 birds each. The chicks were wing-banded and placed in wire-floor Oakes electric battery brooders for a period of 3 weeks. They were transferred to intermediate battery brooders without heat until 6 weeks of age and then moved to outdoor all-wire 4 ft. x 5 ft. developer pens until 9 weeks of age. They were fed the diets shown in Table 1.

In treatment 1, the birds were fed a 16 percent protein diet (Ration A) from 1 day to 9 weeks of age, whereas in treatment 2, the birds were fed a 20 percent protein diet (Ration B) from 1 day to 3 weeks of age and then finished with Ration A. The cockerels in treatment 3 were fed Ration B from 1 day to 6 weeks and then finished with Ration A. Those in treatment 4 were fed Ration B from 1 day to 9 weeks of age. Data were obtained on feed consumption, body weight, and mortality.

TABLE 1. Composition of diets used in Experiment 1

Ingredients[1]	Ration A	Ration B
	%	%
Cellulose, ground	3.00	–
Corn, ground yellow	68.70	61.10
Soybean oil meal (44% protein)	21.30	31.90
Alfalfa meal (17% protein)	3.00	3.00
Defluorinated phosphate	3.00	3.00
Salt, iodized	.50	.50
Premix W2	.50	.50
Total	100.00	100.00
Analysis, calculated:		
Protein, %	16.0	20.0
Calcium, %	1.15	1.18
Phosphorous, %	.84	.89
Metabolizeable energy per pound	1306	1306

[1] Premix W2 supplies the following per pound of mixed feed: Vitamin D3, 100 I.C.U.; riboflavin, 0.4 mg.; pantothenic acid, 2.0 mg.; niacin, 2.0 mg.; choline, 10.0 mg.; vitamin B_{12}, 0.002 mg.; procaine penicillin, 0.002 mg.; and vitamin E, 0.2 I.U.

The birds which died during the first 2 days of the study were replaced. It was assumed that mortality occurring during this time was not caused by treatment.

The data were statistically analyzed according to Duncan's multiple range test (1955) and Kramer's modification of the multiple range test for group means of unequal replications (1956).

Results and Discussion

Table 2 summarizes the data obtained with New Hampshire cockerels. Six-week and 9-week body weights were significantly affected by treatment. Cockerels which were fed the 16 percent protein diet starting at 1 day of age were significantly lighter than those fed the same diet at 3 weeks, at 6 weeks, and those fed the 20 percent protein diet from 1 day of age to the end of the experiment. Six-week body weights of the birds in treatment 2 were significantly lighter than those in treatment 4. However, at 9 weeks no significant difference between the same treatments were found.

TABLE 2. Summary of data obtained with New Hampshire cockerels, Experiment 1[1]

	Treatment[2, 3]			
	1	2	3	4
Weight, 6 weeks; gm.	647[a]	748[b]	774[bc]	812[c]
Weight, 9 weeks; gm.	1125[a]	1288[b]	1334[b]	1385[b]
Feed, 9 weeks; lb.	6.59[a]	7.29[a]	7.38[a]	7.64[a]
Feed/gain; 9 weeks	2.76[a]	2.65[a]	2.68[a]	2.46[a]

[1] Means on the same horizontal line bearing a different postscript letter are significantly different at the 5 percent level of probability.

[2] Three replicate groups, 10 birds each.

[3] Treatment 1 – 16% protein 1 day to 9 weeks
Treatment 2 – 20% protein 1 day to 3 weeks
16% protein 3 weeks to 9 weeks
Treatment 3 – 20% protein 1 day to 6 weeks
16% protein 6 weeks to 9 weeks
Treatment 4 – 20% protein 1 day to 9 weeks.

Feed consumption during the 9-week experimental period ranged from 6.59 to 7.64 pounds. Cockerels in treatment 1 consumed the least, whereas those in treatment 4 consumed the most. There were no significant differences among treatments.

The amount of feed consumed per unit gain in weight ranged from 2.46 to 2.76. There was no significant difference which could be attributed to treatment. Feed efficiency of the birds which were fed the 20 percent protein starter ration for 3 weeks (treatment 2) and 6 weeks (treatment 3) differed only by 0.03 pound per pound of gain. This observation suggests that for over-all optimum efficiency, broilers may be fed a broiler starter diet for only 3 or 4 weeks instead of the conventional 6 weeks.

Treatment showed no effect on livability since no mortality was observed during the 9-week experimental period.

These data suggest the importance of continuing studies on the feeding of broilers with a finishing diet as early as 3 weeks. In this study, cockerels fed a 20 percent protein starter diet for 3 weeks grew as well as those fed the same diet for 6 weeks and also those fed for 9 weeks. Also feed consumption, feed efficiency, and livability were not significantly affected.

EXPERIMENT II

Experimental Procedure

Cockerels: In this experiment, 100 1-day-old cockerel broiler chicks (Brown Ledbrest x Arbor Acres) were used. These birds were treated similarly to those in Experiment I except they were fed commercial broiler starter (S) and finisher diets (F) and were transferred to 2½ ft. x 5 ft. developer pens at 6 weeks of age. The analyses of the diets are shown in Table 3.

The treatments were as follows:

1. Starter ration 1 day to 3 weeks, finisher 3–9 weeks
2. Starter ration 1 day to 4 weeks, finisher 4–9 weeks
3. Starter ration 1 day to 5 weeks, finisher 5–9 weeks
4. Starter ration 1 day to 6 weeks, finisher 6–9 weeks.

TABLE 3. Proximate analyses of commercial broiler diets[1] used in Experiment 2

	Starter		Finisher	
	Guaranteed	Found	Guaranteed	Found
	%		%	
Crude protein	22.0	22.9	20.0	20.4
Crude fat	5.0	5.5	5.0	4.4
Crude fiber	4.0	3.5	4.0	3.9
Ash	9.0	6.6	7.0	5.5

[1] These data were obtained from average figures (Kawano and Oumi, 1964).

At the end of the experiment, the birds were sent to a commercial processing plant for processing and grading.

Data on body weight, feed consumption, mortality, and carcass grade were obtained.

Pullets: This trial was similar to the above, except pullet chicks were used.

As in Experiment I, birds which died during the first 2 days of age were replaced. The data were analyzed according to the statistical methods used by Duncan (1955) and Kramer (1956).

Results and Discussion

Cockerels: In order to further study the effect of duration of feeding the starter diet (feeding duration) on the performance of broilers, 1-day-old broiler cockerels (Brown Ledbrest x Arbor Acres) were tested with commercial broiler starter and finisher rations.

The results appear in Table 4. There was no significant difference in 3-week body weights. This was expected as all the birds were fed the high protein starter diet for the first 3 weeks of age.

Cockerels fed the broiler starter diet for only 3 weeks grew as well as those fed the same ration for 4, 5, and 6 weeks. At 9 weeks, there were no significant differences among treatments. The body weights averaged 4.29, 4.45, 4.28, and 4.35 pounds, respectively, for treatments 1, 2, 3, and 4.

Feed consumption ranged from 8.10 to 8.78 pounds to 9 weeks of age. Cockerels fed the starter ration for only 3 weeks consumed significantly less feed to 9 weeks of age than those fed the same ration for either 4, 5,

TABLE 4. Summary of data obtained with broiler cockerels,[1] Experiment 2.

	Treatment[4]			
	1	2	3	4
Body weight, 3 weeks; gm.	456[a]	465[a]	470[a]	458[a]
Body weight, 6 weeks; gm.	1090[a]	1150[a]	1075[a]	1111[a]
Body weight, 9 weeks; lb.	4.29[a]	4.45[a]	4.28[a]	4.35[a]
Feed consumption, 9 weeks; lb.	8.10[a]	8.78[b]	8.72[b]	8.77[b]
Feed/gain	1.93[a]	2.01[a]	2.08[a]	2.06[a]
Eviscerated grade score[2]	2.87[a]	2.75[ab]	2.44[b]	2.50[ab]
Cost of feed per pound gain; cents	12.12	12.70	13.28	13.10
Cost of feed/bird, 9 weeks; cents	50.88[a]	55.48[b]	55.70[b]	55.79[b]
Selling price/bird, 9 weeks; cents[5]	137.28	142.40	136.96	139.20
Average return; cents[5]	86.40	86.92	81.26	83.41
Mortality[3]	1	1	0	0

[1] Means on the same horizontal line bearing a different postscript letter are significantly different at the 5 percent level of probability.

[2] Eviscerated grades: A=3, B=2, C=1.

[3] Mortality per 30 birds in each treatment.

[4] Treatment 1 – Finisher diet started at 3 weeks
Treatment 2 – Finisher diet started at 4 weeks
Treatment 3 – Finisher diet started at 5 weeks
Treatment 4 – Finisher diet started at 6 weeks.

[5] Calculations based on 32 cents per pound live weight charged to State Poultry Processors.

[6] Average return: Selling price per bird less cost of feed per bird.

or 6 weeks. This was true even though the average body weights at 9 weeks were not significantly different among treatments.

Feed efficiency in this experiment ranged from 1.93 to 2.08. Differences among treatments were not statistically significant.

Eviscerated grades were significantly affected by treatment. When Grades A, B, and C, respectively, were given scores of 3, 2, and 1 for purposes of statistical analysis, the data revealed that there was a significant difference among means. Further analysis showed that only treatments 1 and 3 were significantly different. Although the birds in treatment 1 were fed the high-protein starter diet for only 3 weeks, they showed eviscerated scores which were superior to those fed the same diet for 5 weeks. The observed difference was mostly due to the percentage of breast blisters in treatments 3 and 4.

The cost of feed to 9 weeks of age was significantly affected by treatment. This was attributed to the amount of feed consumed and the cost difference between the broiler starter and broiler finisher diets. Since the starter diet was more expensive, feeding this diet for longer periods of time made the total feed cost greater. Also, as shown in Table 4, the cockerels which were fed broiler starter for only 3 weeks consumed less feed than those receiving the starter for 4, 5, and 6 weeks.

The average feed cost per cockerel for treatments 1, 2, 3, and 4, respectively, was 50.88, 55.48, 55.70, and 55.79 cents. Calculations were based on the cost of the commercial starter and finisher diets charged to the University of Hawaii.

At 9 weeks, cockerels fed the broiler finisher diet as early as 3 weeks made the cheapest gain. The cost of feed per pound of gain averaged 12.12, 12.70, 13.28, and 13.10 cents, respectively, for the birds fed the finisher diet starting at 3, 4, 5, and 6 weeks of age.

The average return per cockerel (selling price less cost of feed) ranged from 81.26 to 86.92 cents. The birds in treatment 1 showed a return of 0.52 cents less than treatment 2, 5.14 cents more than treatment 3, and 2.99 cents more than treatment 4.

As in Experiment I, mortality was negligible. One bird died in each of treatments 1 and 2 and none in treatments 3 and 4.

Results obtained with cockerels in Experiments I and II corroborate each other. In Experiment I, birds which were fed the 20 percent protein starter ration during the first 3 weeks of age grew as well as those fed the same diet for 6 weeks. In Experiment II, the data show that feeding a high (22 percent) protein broiler starter ration for 4, 5, or 6 weeks was not significantly superior to feeding the high protein diet for a period of only 3 weeks. The data are in agreement with known information. According to the National Research Council (1960), the protein requirement of growing chickens 0–8 weeks of age is 20 percent. Results indicate that the use of a 22 percent protein starter ration for longer than 3 weeks is not warranted. It would also be interesting to test the use of broiler starter rations for periods shorter than 3 weeks.

Pullets: The data obtained with broiler pullets are summarized in Table 5. Body weights at 3, 6, and 9 weeks were not significantly affected by treatment. The birds which were fed the starter ration for 3, 4, 5, and 6 weeks weighed 3.47, 3.49, 3.47, and 3.53 pounds, respectively, at 9 weeks.

The pullets in treatments 1, 2, 3, and 4 consumed an average of 7.51, 7.46, 7.77, and 7.63 pounds of feed to 9 weeks, respectively. These differences were not significant. The broiler pullets consumed 8.6 to 13.0 percent less feed than cockerels.

Feed efficiency was not significantly affected by treatment. It took an average of 2.15, 2.14, 2.17, and 2.16 pounds of feed to produce a pound of gain in treatments 1, 2, 3, and 4, respectively. To 9 weeks, pullets required 0.09 to 0.21 pound more feed per pound of gain than cockerels.

Eviscerated grades of pullets were not significantly affected by treatment and breast blisters were not as frequent as among the cockerels.

The cost of feed per pound of gain for the pullets tended to increase with the length of time the broiler starter was fed. The cost of feed per pound of gain averaged 13.72, 13.63, 13.73, and 14.09 cents, respectively, for treatments 1, 2, 3, and 4. The increasing cost was attributed, in part, to the high cost of the starter compared to that of the finisher diet.

The pullets showed a return over feed cost ranging from 61.88 to 64.49 cents per bird. Those in treatment 2 showed the most return, treatment 1 next, followed by treatments 3 and 4.

Pullet mortality was negligible. Two birds in treatment 2 died, whereas none died in treatments 1, 3, and 4.

TABLE 5. Summary of data obtained with broiler pullets,[1] Experiment 2

	Treatment[4]			
	1	2	3	4
Weight, 3 weeks; gm.	423[a]	426[a]	438[a]	425[a]
Weight, 6 weeks; gm.	976[a]	965[a]	992[a]	977[a]
Weight, 9 weeks; lb.	3.47[a]	3.49[a]	3.47[a]	3.53[a]
Feed, 9 weeks; lb.	7.51[a]	7.46[a]	7.77[a]	7.63[a]
Feed/gain	2.15[a]	2.14[a]	2.17[a]	2.16[a]
Eviscerated grade score[2]	2.56[a]	2.46[a]	2.42[a]	2.38[a]
Cost of feed per pound gain; cents	13.72	13.63	13.73	14.09
Cost of feed/bird 9 weeks; cents	47.92[a]	47.19[a]	49.16[a]	49.78[a]
Selling price/bird, 9 weeks; cents[5]	111.68	111.68	111.04	112.96
Average return; cents[6]	63.76	64.49	61.88	63.18
Mortality[3]	0	2	0	0

[1] Means on the same horizontal line bearing different postscript letter are significantly different at the 5 percent level of probability.

[2] Eviscerated grade score: Grades A, B, and C were given scores of 3, 2, and 1, respectively.

[3] Mortality per 30 birds in each treatment.

[4] Treatment 1 – Finisher diet started at 3 weeks
Treatment 2 – Finisher diet started at 4 weeks
Treatment 3 – Finisher diet started at 5 weeks
Treatment 4 – Finisher diet started at 6 weeks.

[5] Calculations based on 32 cents per pound live weight charged to State Poultry Processors.

[6] Average return: Selling price per bird less cost of feed per bird.

SUMMARY

Two experiments involving 360 sexed day-old chicks were conducted to study the effect of broiler starter rations on the subsequent performance of broilers. The first experiment was conducted with New Hampshire cockerels. The second was conducted with Brown Ledbrest x Arbor Acres cockerels and pullets.

Growth to 9 weeks of New Hampshire cockerels fed a 20 percent protein starter diet for 3 weeks and then transferred to a 16 percent finisher diet was not significantly different from those fed the high protein diet for 6 or 9 weeks.

Body weight, feed consumption, feed efficiency, and mortality were similar for birds fed the broiler starter ration during the first 3, 4, 5, or 6 weeks before they were fed the finisher ration.

At 9 weeks, broiler cockerels averaged 4.28 to 4.45 pounds in body weight and consumed 8.10 to 8.78 pounds of feed. Eviscerated carcass grades were not significantly affected by treatment.

Nine-week-old broiler pullets averaged 3.47 to 3.53 pounds, consumed 7.46 to 7.77 pounds. Eviscerated carcass grades were similar among treatments.

The cost of feed to produce a broiler cockerel to 9 weeks ranged from 50.88 to 55.79 cents, whereas the average for pullets ranged from 47.19 to 49.78 cents.

The cost of feed per pound of gain at 9 weeks for Brown Ledbrest x Arbor Acres cockerels averaged 12.12 to 13.28 cents, whereas the pullets averaged from 13.63 to 14.09 cents.

At 9 weeks, the average return over feed cost (selling price less cost of feed) for cockerels ranged from 81.26 to 86.92 cents, whereas the range was from 61.88 to 64.49 cents for pullets. Broilers which were fed the finisher diet at 4 weeks showed the highest return, followed by those fed at 3, 5, and 6 weeks.

The data also revealed that broiler finisher diets may be fed as early as 3 or 4 weeks without significantly affecting over-all performance of broilers at 9 weeks of age.

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